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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/723,812	11/25/2003	Leslie F. Warren JR.	024.0055	9757

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EXAMINER	
FEELY, MICHAEL J	
ART UNIT	**PAPER NUMBER**
1712	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/25/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)
	10/723,812	WARREN ET AL.
	Examiner	Art Unit
	Michael J. Feely	1712

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10 and 38-55* is/are pending in the application.

4a) Of the above claim(s) *1-10* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *38-55* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Pending Claims

Claims 1-10 and 38-55 are pending. Of these, claims 1-10 are withdrawn.

Response to Amendment

1. After further consideration of the instant claims and the prior art of record, the finality of the last Office action is withdrawn.

2. The rejection of claims 22, 26-37, and 56-59 under 35 U.S.C. 103(a) as being unpatentable over Ryang et al. (US Pat. No. 5,962,608) in view of Mehring et al. (New Sol-Gel Routes to Organic-Inorganic Hybrid Materials: Modification of Metal Alkoxide by Phosphonic or Phosphinic Acids) has been rendered moot by the cancellation of these claims.

3. The indicated allowability of claims 38-55 is withdrawn after further consideration of the prior art of record.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 38-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ryang et al. (US Pat. No. 5,962,608) in view of Mehring et al. (New Sol-Gel Routes to Organic-Inorganic Hybrid Materials: Modification of Metal Alkoxide by Phosphonic or Phosphinic Acids).

Regarding claims 38-51, Ryang et al. disclose: ***(38)*** a process for making a polymer composition comprising the steps of:

- contacting a metal oxide precursor with a *multifunctional compound* to form a chelated metal oxide precursor (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6);
- contacting said chelated metal oxide precursor with a *polymer material* (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6);
- at least partially hydrolyzing said chelated metal oxide precursor to form at least partially hydrolyzed chelated metal oxide precursor monomers (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6);
- permitting said at least partially hydrolyzed chelated metal oxide precursor monomers to polycondense to form a metal oxide sol, *the sol comprising a liquid phase and a disperse phase, the disperse phase comprising* nano-clusters having an average size of less than about 1000 nm (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6); and
- producing a polymer composition *having said metal oxide sol* dispersed therein (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6; column 30, lines 20-37);

(39) wherein said metal oxide sol comprises a liquid and a polycondensation product of said at least partially hydrolyzed chelated metal oxide precursor monomers, and the process further comprises the step of removing said liquid before the step of producing (Abstract; column 30, lines 38-45);

(40) wherein said metal oxide sol comprises a liquid and a polycondensation product of said at least partially hydrolyzed chelated metal oxide precursor monomers, and the process

further comprises the step of removing said liquid after the step of producing (Abstract; column 30, lines 38-45);

(41) wherein the step of contacting a metal oxide precursor with a *multifunctional compound* comprises selecting said metal oxide precursor from the group consisting of a transition metal, an alkaline earth metal and a metallic element selected from the group 3A, 4A, and 5A of the periodic table of elements (column 23, lines 17-30); *(42)* wherein the step of selecting said metal oxide precursor comprises selecting said metal oxide precursor from the group of metal oxide precursors consisting of aluminum, antimony, bismuth, calcium, chromium, magnesium, tin, titanium, zinc, and zirconium (column 23, lines 17-23);

(43) further comprising the step of adding to said metal oxide sol at least one ingredient selected from *see claim for list* (column 30, lines 14-19);

(47) wherein the step of at least partially hydrolyzing said chelated metal oxide precursor comprises the step of contacting said chelated metal oxide with a hydrolyzing agent (Abstract; column 22, lines 38-47; column 26, lines 43-57); *(48)* wherein the step of at least partially hydrolyzing said chelated metal oxide precursor comprises the step of contacting said chelated metal oxide with de-ionized water (Abstract; column 22, lines 38-47; column 26, lines 43-60);

(49) wherein the step of contacting said chelated metal oxide sol with a polymer material comprises contacting said chelated metal oxide sol with a polymer material selected from *see claim for list* (column 3, lines 39-53);

(50) further comprising the step of contacting said metal oxide precursor with a solvent before the step of contacting said metal oxide precursor with a *multifunctional compound* (column 22, lines 38-47; column 25, lines 56-67); and *(51)* wherein the step of contacting said

metal oxide precursor with a solvent comprises the step of selecting said solvent from the group consisting of water, alcohols, and glycols (column 22, lines 38-47; column 25, lines 56-67).

<u>*Regarding claims 52-55*</u>, Ryang et al. disclose: ***(52)*** a process for making a polymer composition comprising the steps of:

- contacting a metal oxide precursor with a *multifunctional compound* to form a chelated metal oxide precursor (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6);
- contacting said chelated metal oxide precursor with a *polymer material* (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6);
- at least partially hydrolyzing said chelated metal oxide precursor to form at least partially hydrolyzed chelated metal oxide precursor monomers (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6);
- permitting said at least partially hydrolyzed chelated metal oxide precursor monomers to polycondense to form a metal oxide sol (Abstract; column 22, lines 1-47; column 25, line 56 through column 27, line 6); and
- producing a polymer composition comprising *from about 0.5 to about 30 wt% metal oxide dispersed therein* (Abstract; column 29, line 61 through column 30, line 14), *the metal oxide in nano-clusters having an average size less than about 1000 nm* (Abstract; column 22, lines 23-47);

(53) wherein the nano-cluster average size is less than about 100 nm (Abstract; column 22, lines 23-47); and *(54 & 55)* wherein the concentration of the metal oxide is from about 0.1 to about 10 wt% (column 29, line 61 through column 30, line 14).

<u>*With respect to all of the above claims*</u>, Ryang et al. disclose: "The *multifunctional compound* is ***any compound capable of coordinating to a metal oxide precursor through a chelating functional group***. The multifunctional compound which is contacted with the metal oxide precursors contains at least one react-able functional group and at least one chelating functional group. The chelating functional groups generally coordinate through nitrogen, oxygen, sulfur, ***phosphorus***, arsenic and/or selenium atoms; thus chelating functional groups contain at least one of N, O, S, ***P***, As and Se atoms. Chelating functional groups include...***phosphonic acids***...The chelating functional groups coordinate to (react with) the metal of the metal oxide precursor in such a way to form a coordinated or chelated metal oxide complex that can prevent gelation of the sol by retarding, preventing or partially preventing hydrolysis and/or condensation," (column 24, lines 6-25).

However, they fail to explicitly disclose: ***(38 & 52)*** a source of organophosphinate anions to form a phosphinate-chelated metal oxide precursor; ***(44)*** wherein said source of organophosphinate anions has the formula:

$$\begin{array}{c} \qquad O^- \\ \qquad | \\ R_1 - P = O, \\ \qquad | \\ \qquad R_2 \end{array}$$

wherein R_1 and R_2 are selected from the group of moieties consisting of an alkyl, an aryl, an alkoxy and an aryloxy moiety; *(45)* wherein said source of organophosphinate anions is a phosphinic acid; and *(46)* wherein said phosphinic acid is a diphenylphosphinic acid.

Mehring et al. disclose a two-step sol-gel route to form organic-inorganic hybrid materials by modifying metal alkoxide with phosphonic or phosphinic acid (Abstract). The process involves a non-hydrolytic condensation between phenylphosphonic acid (PPA) or diphenylphosphinic acid (DPPA) and a metal alkoxide. This reaction product is then subjected to hydrolysis/condensation of the remaining alkoxide groups (page 100, column 2). In conclusion, Mehring et al. state that since there is not removal of the PPA or DPPA ligands upon hydrolysis, these modified metal alkoxides appear to be well suited for the synthesis of new hybrid materials (page 102, column 1).

One of ordinary skill in the art would have recognized that the modified metal oxides of Mehring et al. fit the non-limited description set forth in Ryang et al. Mehring et al. also explicitly state that these materials appear to be well suited for the synthesis of new hybrid materials. *Furthermore, one of ordinary skill in the art would have recognized that the chemical nature of these materials would have inherently provided some flame-retardant properties to these hybrid materials due to the presence of phosphorus.* Lastly, it has been found that the selection of a known material based on its suitability for intended use supports a *prima facie* obviousness determination – *see MPEP 2144.07.*

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a source of organophosphinate anions *(including diphenylphosphinic acid)* to form a phosphinate-chelated metal oxide precursor, as taught by Mehring et al., in the process of

Ryang et al. because the modified metal oxides of Mehring et al. fit the non-limited description set forth in Ryang et al., and Mehring et al. explicitly state that these materials appear to be well suited for the synthesis of new hybrid materials.

Previous Arguments & Allowable Subject Matter

6. In the previous Office action, the Examiner noted the following: "Applicant's arguments, see pages 18-19 of the response, filed July 31, 2006, with respect to claim 38 and new claim 52 have been fully considered and are persuasive. The prior art rejection of claims 38-51 has been withdrawn." Applicant's argument stated that the prior art failed to teach or suggest contacting *the polymer material* with the phosphinate metal oxide precursor prior to at least partial hydrolyzing of the precursor.

After further review of Ryang et al., a few passages were found pertinent. Ryang et al. disclose the following:

> "A "sol", as the term is used herein, refers to a composition comprising a liquid colloidal dispersion containing a liquid phase and a dispersed phase. The liquid phase of the liquid colloidal dispersion may be aqueous and/or organic, and in particular, may be at least one of water and organic liquids such as alcohols, glycols and other protic organic solvents. Organic solvents include methanol, ethanol, propanol, isopropanol, sec-butanol, t-butanol, methoxyethanol, ethoxyethoxyethanol, ethylene glycol and propylene glycol. *The liquid phase may also be a liquid or partially liquid substance to which a metal oxide sol can be added such as* ***resin monomers****. For example, in the case where it is desired to incorporate metal oxide sols into a* ***curable resin****, the liquid phase of the metal oxide sols may be constituted by one embodiment of a* ***polymerizable material such as curable resin monomers in liquid form****,"* *(see column 22, lines 1-16)*;

"In another embodiment, the metal oxide precursor is provided ***in the polymerizable material in which the subsequently formed metal oxide sols will be incorporated.*** *For example, if the metal oxide sols are to be incorporated into a* ***curable resin system,*** *the metal oxide precursor can be provided in the monomers of the* ***uncured resin.*** The molar ratio of the amount of the metal oxide precursor combined with the multifunctional compound is from about 1:0.1 to about 1:3, preferably from about 1:0.2 to about 1:1.5, and more preferably from about 1:0.3 to about 1:1.2 (assuming the multifunctional compound contains a bidentate chelating functional group), *(see column 26, lines 1-12)*; and

"Partial hydrolysis may be carried out by contacting the chelated metal oxide precursor with a hydrolyzing agent such as water, and preferably deionized water. The hydrolyzing agent converts the unchelated atoms or groups to hydroxyl groups. In one embodiment, the molar ratio of the chelated metal oxide precursor to water is about 1:0.5 to about 1:3, and preferably about 1:1 to about 1:2. In one embodiment, the chelated metal oxide precursor is contacted with a hydrolyzing agent in a solvent and preferably an organic solvent. *In another embodiment, the chelated metal oxide precursor is contacted with a hydrolyzing agent* ***in resin monomers*** *and/or other ingredients. In this connection, the metal oxide sols can also be prepared* ***in resin monomers*** *without a solvent, or in the absence of a non-reactive element, such as a non-reactive diluent,* as set forth in Example E below," *(see column 26, line 58 through column 27, line 6).*

Taking a closer look at the instant specification, paragraph 0011 defines the phrase *polymer material*:

"As used herein, the term "polymer material" of the various embodiments of the present invention may comprise any conventional polymer or *polymer precursor*. The polymer material may be any material that *comprises or is capable of forming a pre-polymer material, a partially polymerized material or a*

> *polymer.* The polymer material may be *monomers, a B-staged polymer, or a polymer.*"

When discussing the instantly claimed embodiment, the following is disclosed:

> "As described above, the various embodiments of the present invention utilize a stable metal oxide sol to fabricate a homogeneous fire retardant polymer composition. The liquid phase of the metal oxide sol may be aqueous and/or organic, and in particular, may be water and/or organic liquids such as alcohols, glycols and other protic organic solvents. Organic solvents include, but are not limited to, methanol, ethanol, propanol, isopropanol, sec-butanol, t-butanol, methoxyethanol, ethoxyethoxyethanol, ethylene glycol and propylene glycol. *The liquid phase also may be a liquid or partially liquid substance to which a metal oxide sol can be added, such as resin monomers. For example, in the case where it is desired to incorporate metal oxide sols into a curable resin, the liquid phase of the metal oxide sols may comprise one embodiment of a polymer material such as curable resin monomers in liquid form;*" *(see paragraphs 0013)* and,
>
> "The metal oxide sol can be prepared in accordance with the following procedure. A metal oxide precursor is contacted with at least one source of organophosphinate anions. In a preferred embodiment, the metal oxide precursor is provided in an appropriate amount of solvent, preferably in an organic solvent such as an alcohol or glycol solvent. *In another embodiment, the metal oxide precursor is provided in the polymer material in which the subsequently formed metal oxide sol will be incorporated. For example, if the metal oxide sols are to be incorporated into a curable resin system, the metal oxide precursor can be provided in the monomers of the uncured resin,*" *(see paragraph 0022).*

When comparing the passages of the prior art with the passages of the instant invention, it becomes apparent that the methods in each are essentially the same. This is especially the case in light of Applicant's definition of *polymer material.*

Communication

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Feely whose telephone number is 571-272-1086. The examiner can normally be reached on M-F 8:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on 571-272-1302. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael J. Feely
Primary Examiner
Art Unit 1712

January 23, 2007

MICHAEL FEELY
PRIMARY EXAMINER